



LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

Transport of Iodine Species in the Terrestrial Environment

Q. Hu, J. E. Moran, P. Zhao

September 10, 2003

American Geophysical Union Fall Meeting
San Francisco, CA, United States
December 8, 2003 through December 12, 2003

Disclaimer

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

Transport of Iodine Species in the Terrestrial Environment

Q. Hu; J.E. Moran; P. Zhao.

Lawrence Livermore National Laboratory, 7000 East Avenue, MS L-231, Livermore, CA 94550.
925-422-6774; e-mail: hu7@llnl.gov.

The fate and transport of iodine in the environment is of interest because of the large production and release of ^{129}I from anthropogenic sources. ^{129}I has a long half-life (1.57×10^7 years) and exhibits complex geochemical behavior. The main source of ^{129}I in the environment is from nuclear fuel reprocessing facilities; about 2,600 kg from facilities in England and France. During 1944-1972, the Hanford Site in Washington state released about 260 kg ^{129}I . Iodine has a unique and complex chemistry in the environment, and its fate and transport in aqueous environments is dictated by its chemical speciation. In reducing environments, aqueous iodine usually occurs as the highly mobile iodide anion (I^-). Under more oxidizing conditions, iodine may be present as the more reactive iodate anion (IO_3^-), which could lead to retarded transport through interaction with clays and organic matter. Co-existing iodine species (I^- , IO_3^- , I_2 , and organoiodine compounds), in different proportions, has been reported in various terrestrial environments. However, there are conflicting reports regarding the environmental behavior of the different types of inorganic iodine and few publications on organic iodine compounds.

This work examines the sorption and transport behavior of both inorganic and organic iodine species in geological samples from several complexes of the U.S. Department of Energy, where transport of radionuclides, including ^{129}I , may occur. Experiments on soils and sediments from the Savannah River Site in South Carolina, Oak Ridge Site in Tennessee, Hanford Site in Washington, Livermore Site 300 in California, and a surface soil from Santa Fe in New Mexico near Los Alamos were carried out. Samples from Savannah River Site and Livermore Site 300 are available from different depths. In addition, a surface soil of Wisconsin with a high amount of organic matter is utilized. This wide variety of sample types provides opportunities to examine the influence of organic matter, clay mineralogy, soil pH, and texture on the environmental behavior of iodine. The effects of initial concentration and competitive sorption on iodine transport are also investigated.

This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.